How Do We Build Economically Successful CO2 Capture & Storage Projects?

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About ConocoPhillips

- Major international oil & gas company
- Nation's second largest refiner
- Largest US gas producer
- Has a gasification technology
- Substantial experience with gas separation and injection
- Core competency subsurface analysis and risk management; CO2-EOR experience
- Technology leader in heavy oil

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- Believes that we must address Climate Change as a nation and chart a path forward in a global framework.
- “If we wait too long, it won't be an issue of mitigation. It becomes one of adaptation …with society paying a high price .”
  - Jim Mulva, ConocoPhillips Chairman and CEO

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- Actively evaluating technical options and costs for Carbon Capture and Storage projects.

- Undertaking initiatives to increase efficiency and reduce emissions.

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Sharing our perspective on CCS

- CCS is only one mitigation arena, but it will be a major industrial space. We are ready to start.
- Success will require “testing the envelope,” “validating new technologies,” and “managing R & D risk”.
- Valuing carbon in a transparent fashion for the consumers is necessary for CCS investments.
- Small-scale projects will not demonstrate industrial materiality.
- Acceleration of R & D and fast-track testing of new or improved processes is essential for timely success.

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Power and CCS…

- Early CCS projects will require large amounts of additional power (20-40%), a major deterrent.
- Costs and efficiency of CCS must improve dramatically or it will fail in the marketplace.
- Power companies tend to be uncomfortable with the operational complexity of plants w/ CCS.
- We need partnerships for progress.

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Will CO2 EOR Enable CCS?

- Frankly, not in most locations.
- It's NOT about "putting gas down old wells."
- Old fields require major infrastructure; cost of system recapitalization is huge.
- Current Permian projects support ~$10 - 25/tonne delivered at injection pressure, because they leverage big infrastructure.
- Offshore projects challenged even with "free CO2," storage credits and high oil prices.

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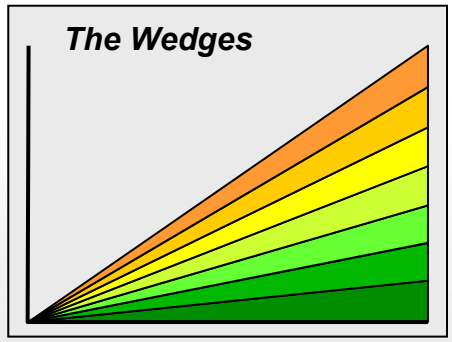
The CCS Vision



- 1 Gt C = 3.7 Gt CO_2 stored /year by CCS.
- Actions reduce emissions, net to the atmosphere.
  - US annual CO_2 emissions ~6 Gt
  - US emissions from Coal ~2 Gt
- Gain benefits from big solutions and niche solutions.
- Drive a commodity business with good regulations and governance.
- It's not just about coal. Think steel, cement. Gasification of biomass with CCS will make real reductions of atm CO_2.

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Reduce CO2 Capture Cost

- The cost prize…A horse race with no clear winner in sight…
  - Oxy-fire
  - Pre-combustion gasification
  - Post-combustion separation improvements urgently need cost reductions.
- Operational efficiencies are real revenue enabler.

  Try them all.

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Serious Questions

- Financial incentives to try new technologies?
- How much research is needed? What is required before we start?
- What is the balance between tests and larger scale action?
- How can we effectively manage risk to accelerate action?

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Rational Objectives

- Get the most bang for our buck.
- “Clean-up” dirtiest first.
- Improve project economics before tackling marginal projects.
- Build integrated regional systems with every piece.
- Prove-in new technologies.
- Encourage innovation and risk taking.

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CCS Costs, Today's Tech

- Larger projects have better $ /tonne metrics.
- Value is maximized with large co-gen plus synergies with industrial gas use (H2, CO, O2, N2).
- Best available technologies
  - $40 - $70 /tonne with lots of synergies
  - Some projects >$180/tonne CO2
  - Not able to "replicate" $25 / tonne.
- Valuing carbon will provide economic framework.

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Does it make sense…

- To start CCS with natural gas?
- To delay starting industrial projects by 10 years waiting for modest demos to prove themselves?

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Industry knows how to inject gas!

- Cumulative 30-yr natural gas recycling at Prudhoe Bay, Alaska
  - ~49 TCF
  - ~275 BCF/yr.
- Permian Basin EOR
  - >40MM t/yr CO2.
- Big projects will sustain robust measurement, monitoring and verification.

** All Prudhoe info calculated from Alaska Oil & Gas Conservation Commission Public filings.*

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Storage: It's about geology…

- Leverage our knowledge base, don't reinvent the wheel.
- Ask the right questions. Use tools to test theories that need testing. Don't just use tools because they're available.
- Ask how..
  - Faults can be great migration barriers for gas
  - Wells don't act as straws
  - The earth has terrific containment systems
  - "Earthquake leaks" from deep reservoirs sounds more like a scary movie than science.

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Natural Containment Systems-- Not one-off reservoirs

- Basins with **multiple** reservoirs, **multiple** seals and **good** hydrodynamic systems.
- Nature's best
  - seal = **salt** layers
  - gas filter = **coal** seams.
- Site selection is key.

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Location, Location, Location…

- Leverage industrial complexes.
- Leverage **major** basin storage systems
  - Gulf Coast, Permian Basin, San Juan Basin, Williston Basin, Illinois Basin…Southern North Sea Basin, Adriatic Basin.

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Ideal Early CCS Projects will

- Add to the power grid.
- Decrease CO2 emissions.
- Use petcoke and coal.
- Leverage industrial synergies.
- Be cornerstones for expansion.
- Make economic sense.
- Encourage R & D innovation.
- Have safe and sound storage sites.

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Where to start?

Where it makes sense.

- ConocoPhillips announced study: Immingham
  - Major UK industrial area, deep water port, Humber Refinery Cogen upgrade.
  - Access ~14% UK CO2 Emissions w/i 50 mi
  - Enable CO2 pathway to So. N. Sea w > 1.6 Gt storage.
- Leverage Cogen at US refinery complexes.
- Consider
  - Value incentives, regulatory framework
  - Carbon-price bridge for early movers.

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The time is now

- There's room for action and we need to move faster than most of us are comfortable doing.
- We don't need to solve everything first. We need to get moving.
- We can adapt our technology and business models.
- We need some federal framework of regulations before we get started.
- Many view "industry" as "the problem."
- ConocoPhillips intends to be part of the solution.
- Global Mitigation is cheaper than Global Adaptation.

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More Information

1. ConocoPhillips website energy section: www.conocophillips.com/energy

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